ELECTRONIC DATA INTERCHANGE

IMPLEMENTATION CASE STUDIES

VOLUME II

INPUT

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Abstract

This report outlines the experience of four companies in implementing electronic data interchange (EDI) programs: British Coal, Intel Corporation, Digital Equipment Corporation, and The Bekins Company.

The report examines the technical and managerial issues these firms encountered in implementing EDI. It also examines the strategic business reasons that compelled these companies to adopt EDI.

The report distills commonalities in experience and benefits gained from a strategic EDI implementation. Such an analysis should provide guidance to any type of company planning an EDI program.

In addition to outlining specific cases and generic benefits, the report also addresses the difficulties in measuring and assessing the impact of EDI. It proposes different evaluation frameworks by which to do this.

The report contains 60 pages and 11 exhibits.

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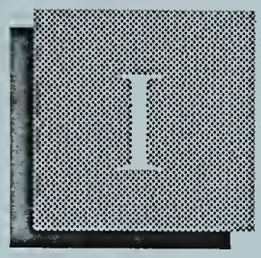

Introduction

I

Introduction

A

Background

This report, produced by INPUT's Electronic Data Interchange Program (EDIP) examines the EDI systems in four corporations.

The case studies presented intend to provide the reader with the specifics and idiosyncrasies of implementing EDI systems. Familiarity with how companies have positioned EDI into their operations and strategic plans should help readers design their own EDI programs.

INPUT defines EDI as the intercompany electronic transfer of business information between applications in structured formats that conform to public or de facto standards (Exhibit I-1).

The information or data thus transferred represents standard business documents such as invoices, purchase orders, and logistical information.

EXHIBIT I-1

Electronic Data Interchange

The Application-to-Application Exchange
of Intercompany Business Data
in Standard Formats

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B

Purpose and Scope

This report places the firm's EDI system in the larger context of a firm's position in a value chain. Within a value chain, a firm is interacting with the following trading partners: "upstream" suppliers, "downstream" customers, and, often, "confederated" production partners.

These points of interaction with trading partners are where EDI can be introduced. In some of the case studies, other interorganizational systems—electronic mail, proprietary on-line ordering systems, CAD/CAM file transfer mechanisms, on-line product data bases—are also used at these points. This report, although mentioning these other systems, concentrates on the application of standard EDI.

An enterprise chooses to adopt EDI for two reasons: one of its important customers asked it to do so, or it wants to gain a competitive edge. This report examines two companies that were motivated by the former reason and two companies that were motivated by the latter reason.

C

Methodology

The four firms that were selected for the study are shown in Exhibit I-2.

Information about these companies was collected from public sources such as annual reports, newspapers and magazines, the trade press, etc.

EXHIBIT I-1

EDI Case Studies

Firm	Industry
British Coal	Mining
Intel Corporation	Electronics Manufacturing
Digital Equipment Corporation	Electronics Manufacturing
The Bekins Company	Transportation (Van Lines)

A case study outline was then developed, along with a list of specific questions and topics for discussion. (A copy of the outline is included as Appendix A.) This outline was used as the basis for examining the target companies by means of interviews with managers and data collection from company and other literature.

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Personal interviews were conducted with key managers responsible for EDI implementation in each firm, except for British Coal, whose study was prepared internally and verified by outside literature.

Visits to the companies were conducted in the cases of Digital and Intel. In the case of Bekins, the outside consultant responsible for preparing the initial EDI feasibility plan was interviewed.

This study reports on the information gained from these interviews and on-site visits.

D

Organization of the Report

The Executive Overview provides an overview of the observations made and the conclusions and recommendations reached through these interviews.

The next four chapters provide the results of the individual firm interviews and researches. Each chapter contains:

- An overview of the firm, its products, and its trading partners.
- A history of the firm's development and experience of EDI systems.
- A review of how the firm implemented EDI systems—from both a management and systems standpoint.
- A listing (where measurable) of the impact of EDI.
- Any conclusions derived from the particular firm's EDI experience.

E

Related INPUT Reports

This report is one in a series published by INPUT's Electronic Data Interchange Program (EDIP). Others in the program include:

- *EDI Intertrends—North America*
- *EDI Intertrends—Western Europe*
- *EDI Standards Reference Guide*
- *North American EDI Service Provider Profiles*
- *North American EDI Software Provider Profiles*
- *EDI and Professional Services*
- *EDI Implementation Case Studies (Volume I)*
- *Advanced EDI Services*
- *Federal Government EDI Initiatives*
- *North American EDI Services Market Analysis, 1988-1993*
- *Vertical Industry EDI Directions and Potentials*
- *EDI and X.400*
- *International EDI*

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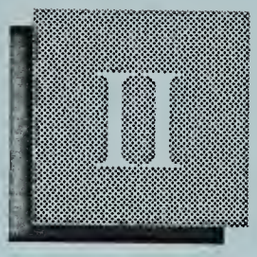
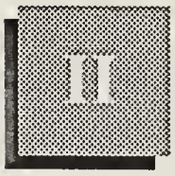


Executive Overview



Executive Overview

A

General Remarks on Evaluating EDI

Quantifying costs and benefits cannot be done for the entire impact of EDI. Seeking a return on investment (ROI) on an EDI installation is not a realistic approach to justifying implementation of EDI. EDI evolves as the company evolves—job descriptions change, relationships with trading partners change, procedures and processes change. Even products change, as in the case of Digital Equipment Corporation, which simplified a subassembly design so that the supplier of that subassembly could manufacture it more easily. Also, market opportunities change with EDI; just the capturing of key accounts due to possessing an EDI ordering capability (as in the case of Bekins) is one example. Because a company is substantially changed, an ROI would constitute an overall evaluation of company performance, thus making EDI's impact difficult to single out.

The full value of EDI is usually realized only if it is implemented in conjunction with other management programs, especially just-in-time (JIT) inventory techniques, flexible manufacturing, quick response inventorying, etc.

The benefits that are derived from a company's effort to implement EDI are not confined to just its own operations but is shared with the operations of its trading partner(s). For example, Digital's sending of its MRPII material needs forecast to Motorola benefits Digital—Digital receives supplies just in time—and Motorola—can plan and manage its production more efficiently.

The question of whether and how to adopt EDI is a question of strategy, not technology. The business purpose and characteristics are much more important than the associated technology.

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Usually, purchasing and logistics EDI benefits the buying company, whereas invoicing and electronic funds payment EDI benefits the selling company.

B

Competitive Advantage and EDI

The competitive advantage that EDI generates is either of two kinds: cost reduction or differentiation of product/service.

The strategic objective to which a firm applies its EDI program depends on the following:

- Complexity of product/service: The provider of simple, commodity products will offer EDI to customers as a differentiator. The provider of complex products brings up suppliers on EDI to reduce cost and to simplify its own operations.

- Trading relationships where transactions are most numerous: Two areas must be considered here—whether the bulk of transactions are on the customer or supplier side and within a given side, what top trading partners provide the most volume of trade. When there is a specific subsection of the firm's total trade transactions that are significantly higher than the other sectors, EDI can be applied for a cost advantage.

- Whether or not competitors use EDI: In the long run, EDI will become a standard business practice. For the early adopters of EDI, it is a competitive advantage. As more firms adopt it, it becomes a means to attain competitive parity. Finally, as most firms in an industry adopt it, it becomes a competitive necessity.

Exhibit II-1 shows when EDI is a means to attain competitive advantage.

C

Comparison and Discussion of the Case Studies

Comparing the two manufacturers examined in this report (Digital and Intel), the differing natures of each company are reflected in the rationale of each in adopting EDI.

Although both companies are manufacturers, INTEL is much more of a raw components supplier, whereas Digital provides its customers with a highly diversified product line—including physical equipment, software, and systems integration consulting.

Digital's operation is much more complex than Intel's. (Digital's Xcon expert system that automatically configures hardware/software products for customers reflects how complicated its value-adding mission is.) Digital deals with a greater number and variety of suppliers than Intel does. The products Digital delivers to customers (large, multicomponent

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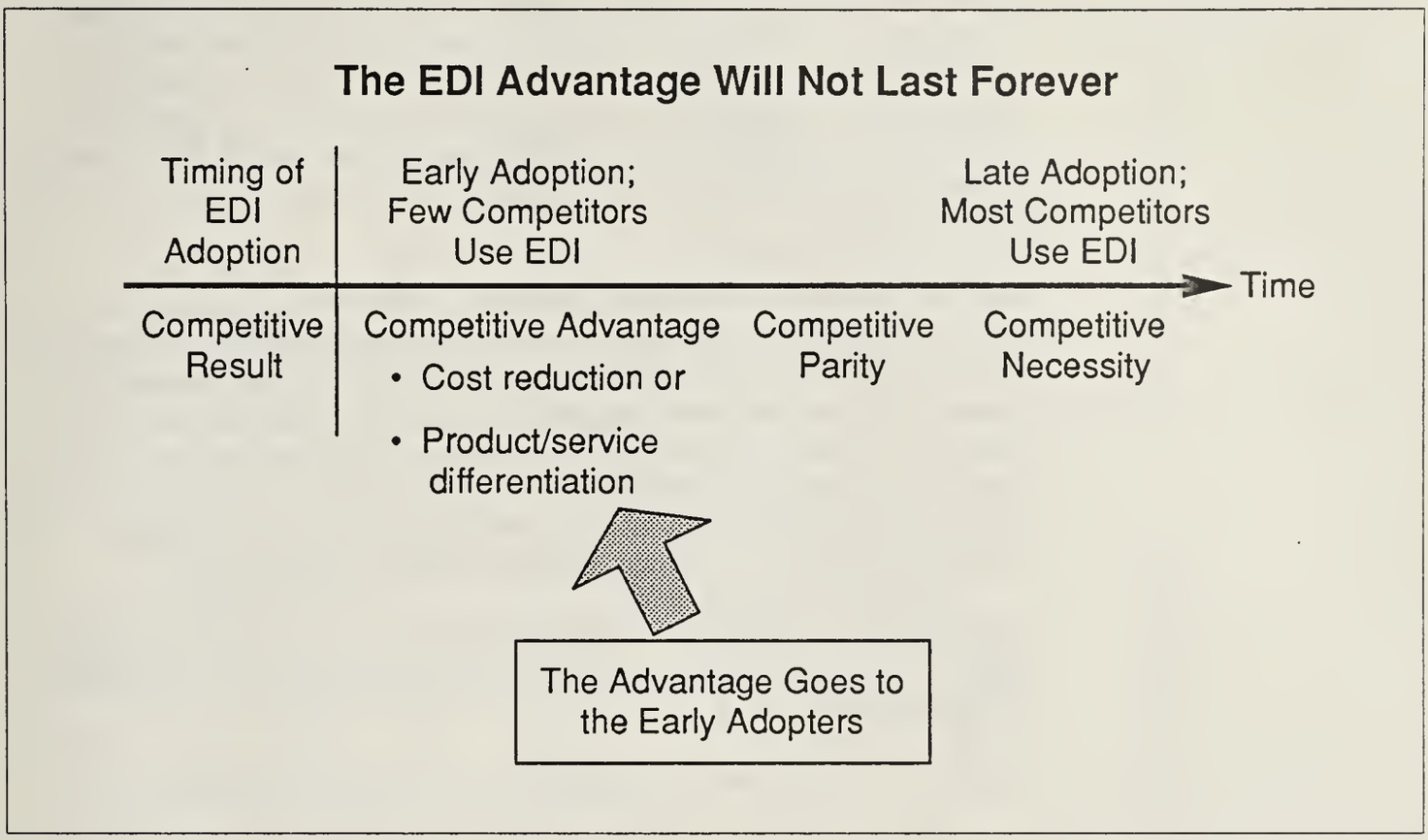
EXHIBIT II-1



integrated computer systems) are produced and delivered by many operational centers within the company. The administration of Digital's operations (product specification, invoicing, distribution, manufacturing, etc.) requires a much higher volume and more detailed level of information than does Intel's.

As a consequence, Digital is adopting EDI as a method for improving its operations and reducing complexity. Primarily, EDI represents a cost reduction strategic benefit. As such, Digital is implementing EDI primarily with raw material suppliers (semiconductor makers) and transportation suppliers.

Intel, on the other hand, is a simpler operation than Digital in that its product line consists of a limited number of discrete products and it deals with fewer suppliers. Consequently it is conducting EDI not with suppliers but with customers. Its positioning of EDI as a strategic tool is to differentiate itself in the service it offers.

EDI as a service/product differentiator (not a cost reducer) is advanced another step in the case of Bekins. Here, EDI augments an already differentiated service: the handling of delicate goods.

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Van lines, such as Bekins, differentiate themselves from common transport carriers in their extra care services: personnel who handle delicate goods, trucks with air-suspension, etc. Government regulations protect this differentiation in service. Manufacturers of delicate products (photocopying equipment, computers, etc.) use van lines when shipping their products to customers and among distribution sites. Bekins has created a separate transport service—specialty distribution—aimed at these corporate accounts.

The transport of delicate goods, however, is becoming a commodity business as more van lines enter the non-household market. Differentiation on top of this already differentiated service is Bekins' competitive strategy. EDI is a differentiating adjunct to specialty distribution. EDI provides Bekins' customers with a strategic information system for the transport of their products. With EDI in its specialty distribution services, Bekins is not only offering a cushioned egg crate but an information system telling the customer where that cushioned egg crate is.

The strategic goal of British Coal's use of EDI is the reduction of costs. British Coal's implementation with suppliers simply lowers its operational overhead.

Exhibit II-2 summarizes the strategic use of EDI by these four firms.

D

Different Criteria for Evaluating EDI

Evaluating EDI can be done from many perspectives (time improvements, accuracy of data, improved customer relations, integration of the organization, etc.). Placing the benefits into mutually exclusive categories is nearly impossible. Different classifications merely emphasize different components. (For example, accuracy of data is a component of higher productivity and faster cycle times.)

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Comparison of EDI Cases

	Intel	Digital Equipment Corp.	British Coal	Bekins
Initial Reason for EDI	Customer request (follower)	Cost advantage flexibility (leader)	Cost reduction flexibility/lead time (leader)	Customer request (follower)
With	Customers	Suppliers and customers	Suppliers	Customers
Technically Noteworthy Points	Single translator on central CPU	Distributed translation	In conjunction with VAN	VAN does translation
Major Impact	Customer satisfaction	• Supplier lead times reduced by 25 - 50% • Supply inventory reduced by 90% for some items • Supply inventory turns increased by a factor of 11 • Dollar value of supply inventory cut in half	• Clerical cost savings of $78,500 per year • Personnel savings of $47,000 per year • Shortened delivery and lead times • Better data and control	• Won $600 -$700,000 customer contract • $40 -$50,000/yr. in cash flow improvement • $16 -$32,000 gained in personnel savings • $3 -$7,000 gained in postal savings
Primary Strategic Advantage Realized	Differentiates product	Reduces cost	Reduces costs	Differentiates product

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Exhibit II-3 is a taxonomy of possible valuation criteria of EDI.

EXHIBIT II-3

EDI's Benefits Can Be Measured according to Different Standards of Value

	Assets	Time	Coordination
Relevant Metrics	• ROI • Productivity • Capacity utilization	Reduction of cycle time periods: • Receiving trading partner acknowledgement of message received • Receiving/delivering product • Inventory turns	• Error counts • Product quality • Service levels • Customer satisfaction • Trading partner relationships • Product design effectiveness • Inventory levels
Drawbacks of Approach	Hard to distinguish EDI contribution	Doesn't reflect all the benefits	Hard to measure quantitatively
Benefits of Approach	Accepted by management; easiest way to identify advantages	Captures the thrust of EDI	Captures the thrust of EDI

A few basic frameworks for evaluating the benefits of EDI are discussed in this section. The benefits are the same in many cases, whereas the emphasis is different.

1. EDI as a Means of Leveraging Corporate Assets

One way the benefits of EDI can be classified is to look at how corporate assets are leveraged.

EDI leverages four broad categories of corporate assets: inventories, cash, people and physical plant.

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a. Inventories

- *Raw material inventories*. Firms carry less inventories because EDI allows them to purchase in a JIT mode, i.e., fewer quantities at more frequent intervals.

- *Final product inventories*. With forecasts from customers and no mail float, the manufacturer can supply its customer faster. In the case of transportation, the cargo space on a truck (for example) is inventory. EDI allows the carrier to sell and utilize that cargo space/inventory in a more optimal manner.

b. Cash

- Less money is tied up in inventory (money in inventory either costs interest payments to a lending institution or it costs in forfeited interest payments that could have been received).

  - Billing customers is faster with EDI invoices than with paper invoices.

  - If the customer is paying electronically, payment comes faster.

  - If the buyer is paying electronically, price discounts may be attained.

c. People

- Clerical labor is eliminated or minimized.

- Professional buyers and salespersons are given more time to concentrate on quality time with trading partners and others in the value chain.

- Management has better data on the company's operations on which to base decisions.

d. Physical Plant/Fixed Assets

- Frees square footage that otherwise would be devoted to carrying buffer inventories

- Affords greater manufacturing flexibility

- Less need for file cabinets, paper forms, administrative materials, postage

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2. EDI as a Means for Improving Time Cycles

When EDI is implemented with suppliers, direct benefits can be as follows:

- Reductions in time
  - Expended for purchasing administration (improved buyer productivity)
  - Working with suppliers on coordinating product design
  - For the supplier to confirm an order (improved administrative cycle time)
  - For the supplier to deliver an order (improved order cycle time)
  - That supply inventory sits idle (increased supply inventory turns)
  - Expended in accounting by reconciling and paying invoices

When EDI is implemented with customers, direct benefits can include the following:

- Reductions in time
  - Informing the customer about the product
  - In receiving accurate, early purchasing forecasts from customers
  - That final-product inventory sits idle (increased final-product inventory turns)
  - Expended in accounting by receiving and reconciling payments

Overall, the benefits from the standpoint of time reduction can be summed up by saying that EDI shortens the time required for a firm to get products to market.

3. EDI as a Means for Improving Coordination/Productivity

EDI streamlines administrative cycles.

- Acknowledgments of documents received (purchase orders, invoices, etc.) bring better control over the process.
- Automatic and timely error checking on documents ensures that no abortive clerical or computer processing effort is expended.

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EDI allows buyers and sales personnel more time to develop cooperative and mutually productive trading arrangements.

EDI generates more reliable/accurate information with which to manage. Source data drives the system and therefore keeps processes accurate (as with the case of Digital, which uses the MRPII data to automatically generate purchase orders). Information/data is entered once or generated automatically from other processes/applications. Thus, errors from human keypunching and manual processing are minimized. Data from transport carriers allows shippers to estimate delivery times or where inventories are being held in public warehouses.

EDI smooths out manufacturing schedules and inventory levels. With EDI forecasts, suppliers can better plan manufacturing. Oscillations in inventory levels are minimized.

E

Key Factors in a Successful EDI Implementation

- Get top management support. Adopting EDI as a method of business impacts many areas of the firm and therefore requires top management to authorize and give strategic guidance. Purchasing, order processing, accounting, distribution, and warehousing at least will be affected by a single EDI program. EDI changes the company's method of adding value. Thus, it necessitates an implementation perspective at the highest level.

- Develop an integrated business plan. List what the goals are for implementing EDI, what documents will be traded, who the pilot team will consist of, and who the trading partner(s) will be; develop a plan for each partner; determine how the telecom connection will be made; establish guidelines; and monitor the project.

- Assemble a cross-functional team. Include members from manufacturing, purchasing, information systems, accounting/finance, order processing, marketing, materials, and logistics.

- Select a pilot trading partner carefully. Launching an EDI program is most successful with a trading partner that already has experience with and is currently utilizing EDI.

- Educate people in the organization.

- Work with a value-added network (if networks are to be used) in coordinating with trading partners.

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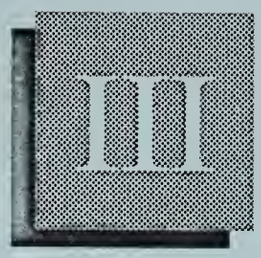
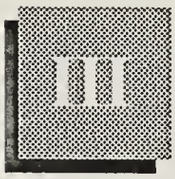


British Coal



British Coal

A Corporate Overview

In 1988, British Coal (Cannock, U.K.) purchased $2.04 billion in goods and services, added value to them and resold the result for $6.9 billion. (All monetary values in this case study assume an exchange rate of £1.0 = $1.57.) A traditional mining company, British Coal (BC) sells coal to utilities and large manufacturing plants in the U.K. and Europe.

British Coal uses EDI for purchasing supplies and equipment. EDI linkages with its customers are only on the drawing boards.

The bulk of BC's purchasing is centralized at its headquarters office. Some purchasing, however, is left to its more than 100 production points. Each production point has its own inventory of supplies which are, in turn, fed by a network of nine central warehouses.

BC trades with about 12,000 suppliers, although 80% of all purchases are made from 2,500 in negotiated contracts with releases. More than 200,000 items are stocked in BC supply inventories.

Computer systems that handle purchasing and inventory control functions are based on mainframe computers located at the main computer center. Four-hundred terminals are linked to the system both at headquarters and down to the coal mine level at various mining sites. BC buyers generate more than 600,000 orders per year.

Invoice processing is centralized at one location that currently receives over 1.75 million invoices per year. Some invoices are sent electronically from suppliers, while the bulk are keypunched manually. Invoices are automatically matched with their corresponding purchase orders for price and quantity. For those that match—and 75% successfully do match—payment is automatically generated.

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B

Trading Partners

British Coal's EDI trading partners consist largely of engineering firms, electrical equipment manufacturers, chemical suppliers, and distributors of various commodities. The size of these firms vary from less than $1 million to those in excess of $1 billion.

C

History of EDI at British Coal

In 1982 British Coal began trading electronically with suppliers. Direct computer-to-computer links with 12 leading mining machinery manufacturers were established. Primary transactions were purchase orders and invoices, yet in some cases, forecasts, prices, and lists of available spare parts also were transmitted. Data formats were proprietary and each trading linkage required a dedicated communications port on BC's mainframe.

By 1984, 14% of all BC purchase orders and 4% of its invoices (in monetary volume) were exchanged electronically.

The early success in electronic trading prompted a decision to expand the service to embrace as many suppliers as possible and to increase the range of documents exchanged.

In 1985, a working group with senior representatives from finance, purchasing and inventories, marketing, and information technology was formed.

The group surveyed the leading VANs for service features. They also polled their leading suppliers on EDI. Most suppliers, even many who were ignorant of EDI, were willing to participate in EDI.

A large number of BC's suppliers are relatively small organizations that have little or no computing abilities. A VAN service was desired that was not only reliable but inexpensive to set up and that had low operational fees.

In fall 1986, BC requested tenders from the U.K.'s two leading EDI VANs, Istel's EDICT and ICL's TRADANET. BC chose Istel's EDICT.

D

British Coal's Current EDI Implementation

British Coal maintains one of the largest EDI implementations in Europe. As of mid-1989, 146 suppliers were trading electronically with the company. Counting the number of order offices, subsidiaries, and trading partner divisional offices, the number of trading points exceeded 500 at that time.

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More than half of the corporation's top 100 suppliers receive orders and send their invoices electronically. As of mid-1989, British Coal sent 29% of all orders and received 12% of all invoices electronically. In addition, the company is implementing two new trading partners per week.

British Coal is establishing electronic mail links with suppliers. In addition, it is developing an electronic funds transfer capability to pay suppliers based on matching invoices to purchase orders.

E

Transaction Sets

BC adopted the Odette standard for invoices and the Tradacoms standard for purchase orders. Odette is a pan-European standard developed by the Society of Motor Manufacturers and Traders (SMMT). Tradacoms, developed by the Article Number Association, is the prevailing standards family in the U.K.

Originally, BC considered developing its own proprietary formats modeled around the messages being utilized with existing suppliers. This was rejected because BC wanted to be prepared to link into other industry groups in the future as EDI became more prevalent in the U.K.

BC is monitoring developments with the EDIFACT body of standards with a view to adopting them as they receive wider acceptance.

F

Infrastructure

British Coal primarily uses Digital and IBM computers. The Digital equipment operates at coal mines for the remote control and monitoring of equipment. A cluster of IBM equipment forms the backbone of BC's data centers and has 4,000 terminals attached to it.

G

How British Coal Implemented EDI

According to William L. Bedford, BC's Chairman of the EDI steering committee, "The successful implementation of EDI has required commitment from the senior management of a number of departments within British Coal."

A steering group was established for liaison and coordination among different departments of the company.

The steering group was composed of representatives from information technology, supply and contracts, finance, marketing, and British Coal's external remote computer bureau, Compower. Besides the information technology personnel, the other groups represent those commercial user departments that are actively involved with trading partners, and can monitor the effect of EDI links, and identify areas for additional development. The steering group meets every six weeks.

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Before making a commitment to Istel's EDICT network service, a two-month pilot was run with two of British Coal's suppliers that already were subscribers to the Istel service. The decision to proceed with the full EDI service was made after successful completion of the trial in February 1987.

The initial stage of the implementation program involved the identification of the main suppliers by volume of orders and invoices to British Coal. These firms were invited to a series of seminars run jointly by British Coal and Istel at which the case for EDI and British Coal's commitment to the project were put forward.

After each seminar, individual suppliers were approached by BC to encourage them to make the commitment to EDI. This involved contact by Istel, supported where necessary by systems development staff to handle any technical queries. British Coal commercial staff simultaneously emphasized the potential commercial benefits of EDI.

Over a two-year period, a series of seminars brought together some 300 suppliers. These targeted suppliers represented British Coal's top trading partners in terms of commercial exchanges. Converting these exchanges to electronic trading promised to bring British Coal the greatest gain.

On average, it takes about 12 weeks from the time a supplier signs an agreement with Istel (BC's VAN) to initiation of live transactions. The delay is primarily due to the software development needed by the supplier. To shorten this lead time, British Coal, using its external computer services bureau, Compower, developed a low-cost PC package for data capture and data entry.

The package is sold for less than $314. With a standard PC and modem, a supplier is able to plug into the EDICT network. The package usually is not integrated with other computer systems at the supplier's premises. It acts like a facsimile machine. It is designed as an interim solution until the supplier can develop an EDI system that integrates with its internal applications.

BC's implementation plan will expand to new areas in the future:

- Having targeted key suppliers in terms of invoices and orders, British Coal will begin pursuing second-tier suppliers.

- BC is laying plans to implement the following additional message types: invoice status reports, remittance advices, order amendments (change orders), order acknowledgements by exception, delivery schedules, and supplier inventory advice notes.

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- Work is commencing to link with British Coal's customers.
- The earliest electronic trading partners that have maintained direct links to British Coal are moving toward VAN connections with the company.
- British Coal has been instrumental in encouraging its VAN Istel to interconnect with the U.K.'s other leading EDI VAN, INS Tradanet. The interconnection will allow British Coal to link with other companies on that network.

H

Costs

BC's cost to develop its EDI capability has been $110,000 over the two-year period from 1987 to 1989. This amount represents the system development work plus the person hours devoted to meeting with suppliers and assisting them with EDI implementation.

Implementation costs to the typical supplier, however, have been, on average, $3,140 per year.

British Coal's expenditure is a result of its desire to maintain a driving role in its industry sector.

I

Impact

To date, BC has realized the following benefits:

- Cost savings as a result of reduced paper handling and keying-in of original documents is estimated to be $78,500 per year.
- General reductions in work associated with invoice handling bring cost savings of around $47,100.
- Automatic rejection of invoices with invalid or incomplete data ensures that no abortive clerical or computer processing effort is expended.
- Confirmation that data has actually been received by the supplier is available.
- Rapid transmission of documents between British Coal and suppliers.
- Error-free transmissions of documents, avoiding mistakes arising from rekeying.
- Shortened delivery cycles and lead times.

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In addition, BC anticipates the following benefits:

- Reductions in inventories (due to shortened lead times and simplified administrative processing) that free up $4.7 million per year.
- Greater control over timings of deliveries, especially for JIT provisioning of workshops.
- Pricing discounts with suppliers as suppliers take advantage of improved cash flow arising from faster payment of invoices.

J Lessons Learned

Persuading suppliers to commit to EDI has been more troublesome than BC anticipated. About 25% of the firms accepted the invitation to go EDI; 25% rejected it outright. The remaining 50% required time-consuming marketing consultations by British Coal and Istel. The reluctance arose more out of limited IS resources on the part of the suppliers than acceptance of the EDI concept. British Coal's development of a low-cost PC translator package has proved invaluable in resolving this barrier.

Implementing EDI purchase orders proved easier than EDI invoices from an operational standpoint. A number of reasons explain the difference:

- Supplier accounts with fixed-payment agreements see little benefit in accelerating the transmission of invoices. These suppliers are not committed to developing EDI capabilities in the invoice area.
- Telephone orders by British Coal buyers often result in the details of the order (e.g. order number, location code, etc.) not being recorded on invoices. Consequently, when the electronic invoice reaches British Coal's accounts payable system, they are rejected. Consequently, British Coal developed a system capability that generated reports on invoice mismatches. The reports are electronically sent back to the supplier and show which invoices were rejected and why.

System support was larger than anticipated because order data formats were modified after the initial implementation. The software package for the PC was beneficial because it allowed for efficient updating of formats (British Coal simply distributed a new diskette containing the new formats to its suppliers).

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Intel Corporation

IV

Intel Corporation

A

Corporate Overview

Intel Corporation (Santa Clara, CA) is one of the largest semiconductor manufacturers in the world. In 1989, with approximately 21,000 employees in 118 geographic sites, Intel delivered 20,000 product types (usually aggregated to 5,000) for total year-end sales of $2.87 billion. In particular, information systems and EDI played important roles in coordinating this activity.

Today, approximately 7% of Intel's orders ($200 million) are executed via EDI.

B

Product Line

- Microprocessors
- Microprocessor peripherals
- Microcontrollers
- EPROMs
- Microcommunication products
- Application-specific integrated circuits (ASICs)
- OEM modules and systems
- Personal computer enhancement products

Following its founding in the late sixties, Intel originally flourished as a supplier of semiconductor memories for mainframe computers and minicomputers. Since 1980, markets and, subsequently, Intel have changed. Microcomputers are now the largest, fastest-growing segment of computing, and Intel is focused on this segment.

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C
Trading Partners and Interorganizational Systems

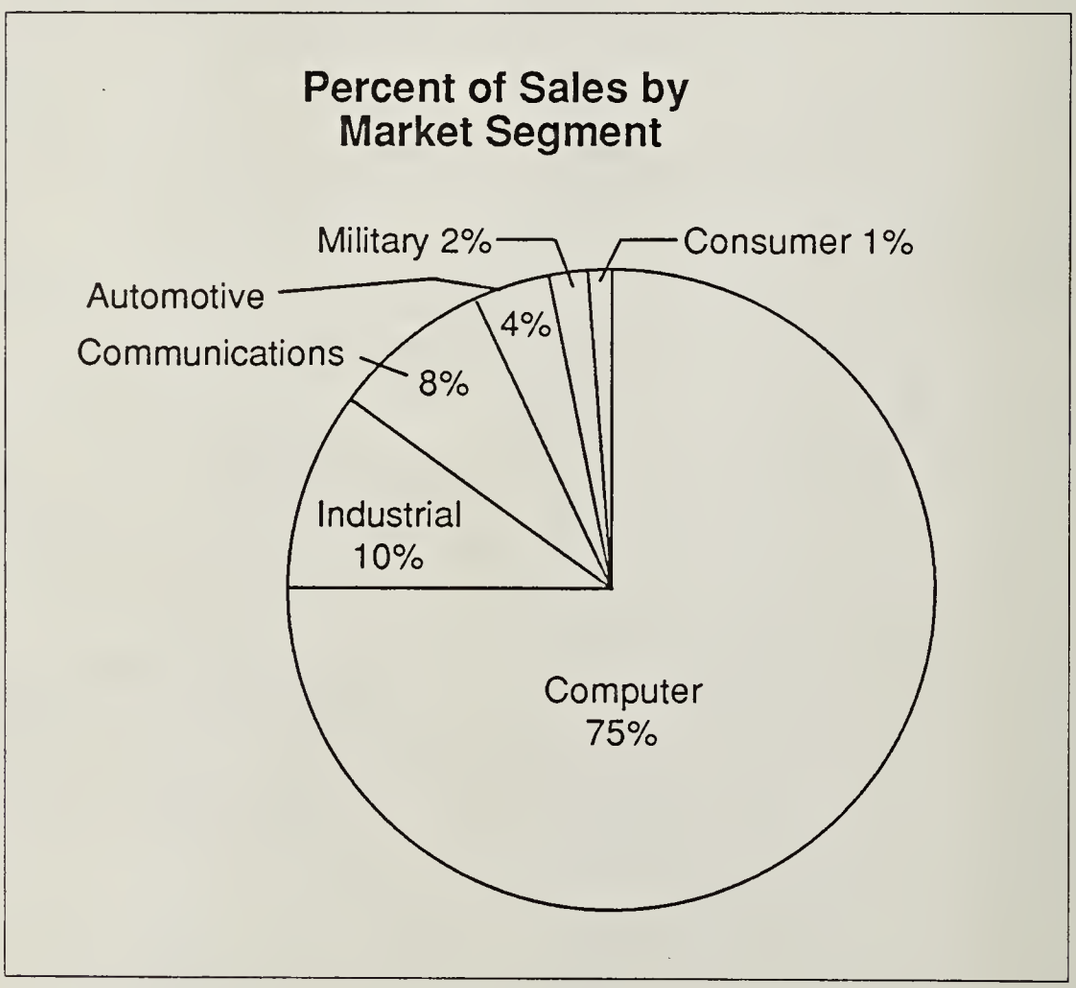
Intel is tied electronically with a variety of trading partners using a variety of interorganizational systems, such as:

- It is linked via standard ANSI X12 EDI with customers and suppliers.
- It offers on-line access to technical and reliability data bases for field service reps, customers, and distributors.
- It transfers CAD/CAM data with photomask subcontractors.
- It exchanges purchase orders, invoices, inventory data, sales data and pricing data with its distributors in proprietary formats.

1. Customers

Three-fourths of Intel's sales are made to computer-product manufacturers. Exhibit IV-1 shows the primary industry categories Intel sells into.

EXHIBIT IV-1



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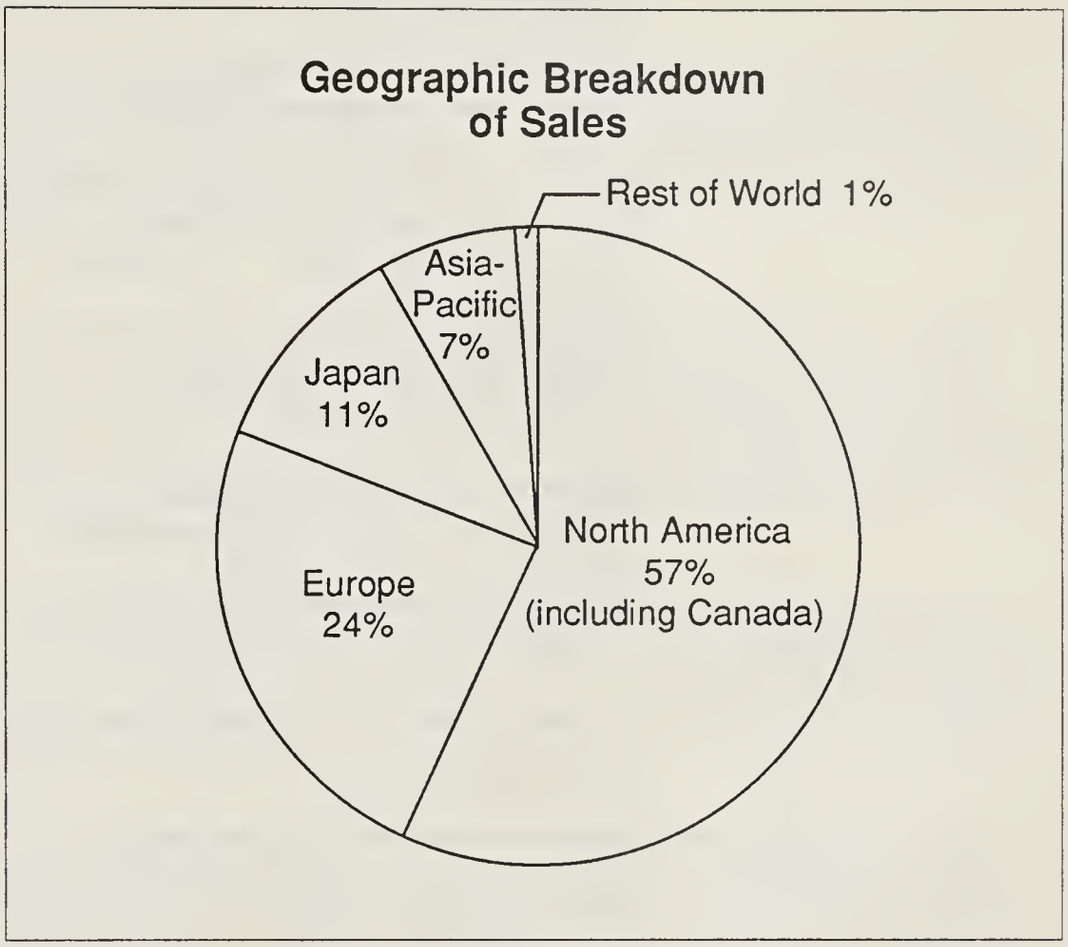
More than half of Intel's revenues come from customers in Canada and the U.S., as shown in Exhibit IV-2.

EXHIBIT IV-2



a. OEM Customers

Intel sells its microcomputer components, modules, and systems directly to companies that incorporate them into their computer systems.

Fifteen of Intel's largest customers use EDI to send purchase orders or material releases, accounting for 7% of Intel's sales.

Customers and distributors initiate a commercial transaction by sending a purchase order (PO) or a materials release. Intel checks its mailbox for incoming POs twice a day on each of its three VANs. The POs are loaded into Intel's Sales Tracking and Reporting (STAR) system.

Every morning, field service engineers log on to STAR and check for new orders. They selectively process the orders on-screen, checking for correct prices, addresses, and other data elements. Once verified for accuracy, the service engineers forward the order (via the STAR system) to the appropriate distribution warehouse for fulfillment.

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All transactions among customers are in ANSI X12 formats.

Currently used transaction sets from customers include the following:
- Material releases (830)
- Purchase orders (850)
- Change-order requests (860)
- Functional acknowledgments (997)

In the future, customers will also send the following:
- The payment order/remittance advice ((820)
- Request for quote (840)
- Receiving advice (861)
- Shipping schedule (862)
- Product transfer and resale (867)
- Order status inquiry (869)

Intel currently sends the following:
- Purchase-order acknowledgments (855)
- Advance-ship notices (856)
- Change-order acknowledgments (865)
- Functional acknowledgments (997)

In the future, Intel will also send the following:
- An invoice (810)
- Price sales catalog (832)
- Response to request for quote (843)
- Inventory advice (846)
- Order status report (870)

b. Distributors

About one-quarter of revenues come from sales to electronics distributors that resell to tens of thousands of customers.

Intel's first use of interorganizational electronic systems was its connection to distributors. The system is called the Distribution Activity Information System (DAIS). It uses proprietary formats but is being converted to ANSI X12 formats.

DAIS allows distributors:
- To monitor what merchandise is available in Intel warehouses (in a proprietary format)
- Send purchases electronically (now in X12 format)
- Track their purchasing pattern (in proprietary format)
- Receive electronic invoices from Intel (in X12 format)

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The DAIS ties into Intel's internal order processing system, STAR (Sales Tracking and Reporting system).

c. Retail Computer Stores

In the past few years, Intel has sold personal computer enhancement products through a network of more than 2,000 retail computer stores. Intel uses a third-party distributor in Oregon, PCEO Inc., to sell to these outlets. The distributor places orders directly into the STAR system.

2. Suppliers

Intel's EDI links with its suppliers began in September 1989. At this writing, four suppliers are at the pilot stage, receiving purchase orders from Intel. One of the suppliers is an Intel division (the systems group, which makes board-level computers), and it is buying components from the components group. The three others are electronic components and equipment makers.

Intel uses the AMAPS purchasing software, produced originally by Comserve, and now sold by MSA. Intel buyers key in orders at terminals from any of Intel's 13 purchasing offices worldwide. The data is transmitted to the translation software in Folsom, CA, where it is then routed to one of Intel's three third-party networks.

Intel's manufacturing resource planning software delivers on-line and paper reports to buyers to help them formulate purchase plans. Intel's materials group, under the direction of Katherine Elliott, is in charge of corporate-wide procurement for Intel.

3. Subcontractors

Intel exchanges design data with subcontractors. To date, this exchange is not performed using EDI standardized formats. It is simply a file transfer, done over either a telecommunications connection or via magnetic tape.

Every Intel semiconductor product requires the creation of a photomask and goes through a wafer fabrication process. A design for a semiconductor is transformed from a large drawing to a photograph, or photomask, that can be inserted into a lithographic system that manufactures small, silicon-based components. Intel operates its own photomask shop in Santa Clara. It subcontracts with three outside shops as well: one in Santa Clara, one on the East Coast of the U.S., and one in the Far East.

To transfer design information, Intel uses a combination of network transmission and the mailing of magnetic tapes. To guard against unauthorized intercepts, a single design is sent partially by tape and partially by telecommunications.

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D

EDI Technology Infrastructure

1. Networks

a. External to Intel

To reach trading partners, Intel uses three EDI networks: BT TYMNET/ EDI*Net (formerly McDonnell Douglas), GEIS EDI*Express, and IBM Information Network.

b. Internal to Intel

For data communication within Intel, the company has a global SNA network that is supported by dedicated lines from Sears communications company and AT&T.

2. EDI Software and Platform

Intel uses Transettlement's TranSlate EDI package and runs it on an IBM 3090 mainframe in its Folsom, CA, data center. This is the central hub for all EDI at Intel except for Europe.

3. Integration with Internal Applications

a. AMAPS

Intel's manufacturing planning and purchasing system is AMAPS. Intel has no automatic generation of purchase orders at this time. Intel buyers receive reports from AMAPS telling them what materials are needed.

b. STAR

The Sales Tracking and Reporting system ties the sales offices, warehouses, and manufacturing sites together. This is a globally accessible data base that funnels all Intel orders and matches them with available product inventories. On the front end, sales offices enter orders. On the back end, manufacturing facilities enter the products that have been produced. Intel builds to stock, not to backlog or customer order. Its manufacturing, however, is based on forecasts.

Exhibit IV-3 depicts Intel's important trading partners and the electronic systems linking them.

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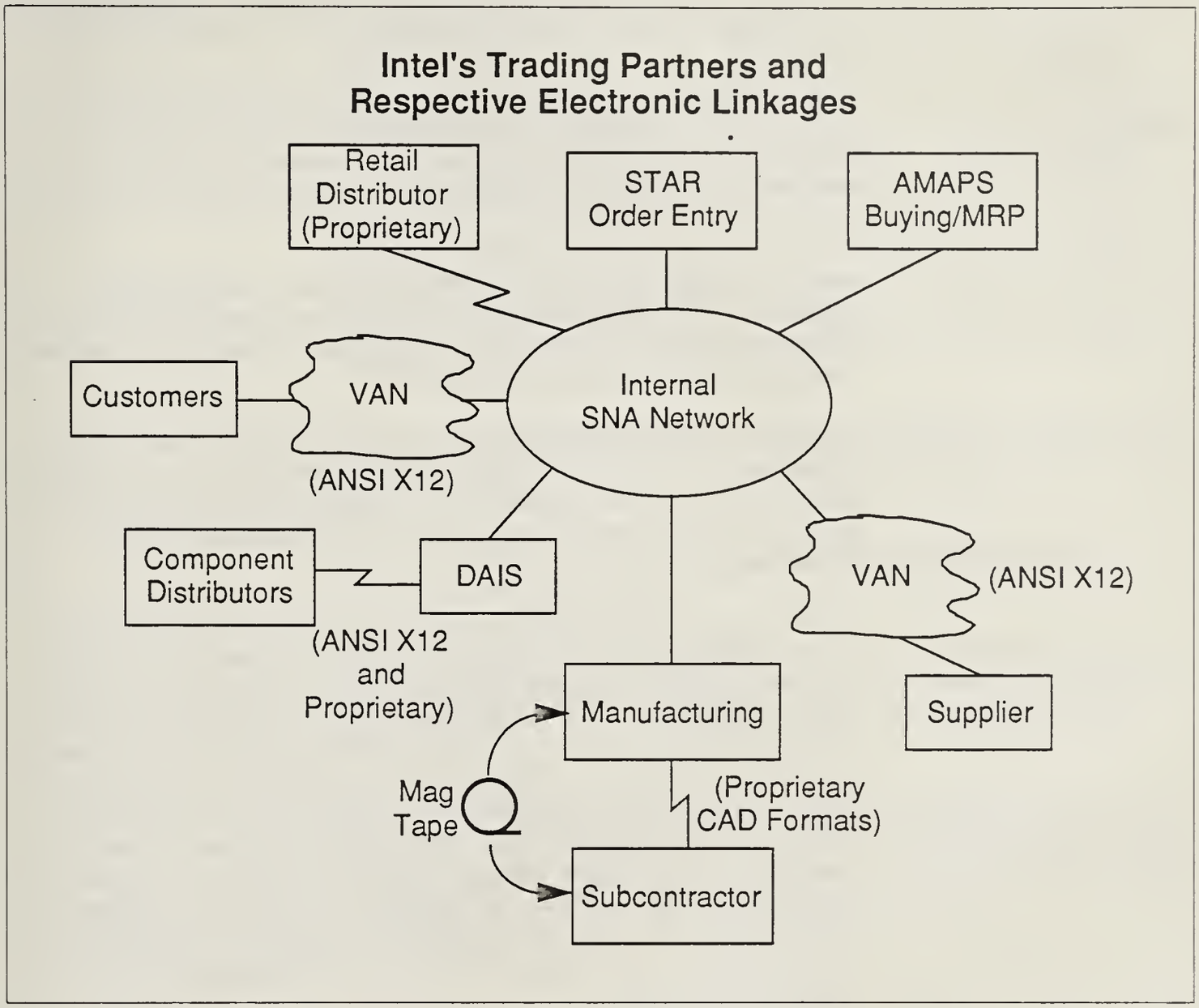
EXHIBIT IV-3



E

History of EDI at Intel

Intel first began electronically exchanging data with trading partners in 1981. Over a direct link with distributors, Intel would send pricing information on products. Distributors sent sales and inventory data in nonstandard data formats. The practice continues today. Intel plans to convert its sending of pricing information into an X12 format (price catalog).

In 1986, major corporate customers (i.e., automobile manufacturers and IBM) asked Intel to send them electronic purchase orders in X12 format. Two people were given the task of procuring an EDI translator and building a working EDI capability. Reacting to a customer request, the

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Intel task force had no plans to integrate the translator with other parts of the system. The initial EDI system simply printed out purchase orders, which were then re-keyed into Intel's STAR order processing system.

In 1987, the corporate sales and marketing group, under the direction of Sallee Peterson, recognized the strategic benefits of EDI not just in building close ties with the customer, but throughout many functional areas within Intel. Her group became the champion of the EDI cause in the company.

Peterson's group assigned seven members of the its dedicated MIS support staff to be EDI developers. (Intel has no central MIS staff. Functional areas within the company have their own complement of support personnel including MIS personnel.)

In addition, Peterson persuaded other functional areas of Intel to begin considering how EDI could be used in their areas. Today, the functional areas active in EDI are finance, materials (procurement), logistics (internal and external transport of products), and the European sales and marketing group.

In June 1988, Peterson decided to create a corporate-wide EDI steering committee and appointed one of her MIS staff, William Pfost, as chairman. The steering committee garners director-level executives and MIS representatives from the following Intel groups: manufacturing, materials, Europe, legal, accounts payable, telecommunications, audit (a corporate-wide accounting function), sales and marketing (components), sales and marketing (systems), accounts receivable/treasury, subcontracting, customer contracts, and logistics. The steering committee formulates and oversees Intel's EDI strategies and objectives. William Pfost's group (from the sales and marketing group) are the technical implementors and coordinators. They attend EDI conferences and report back to the steering committee and the MIS personnel in the functional areas that are developing EDI systems.

Strictly inside Europe, Intel also is using the Tradacoms and EDIFACT standards. Use of these standards is managed by an Intel marketing office within Europe that works with a European trading partner. No international EDI is conducted with these standards. Only ANSI X12 is used for international orders.

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F

Modifications

In converting from paper to electronic POs via EDI, Intel's materials group discovered an advantage of EDI with suppliers. Intel ordered supplies on a release basis. On a single purchase order, the Intel buyers specified items of supplies. For each line item, the buyer further specified a quantity and a week when it was to be delivered. A single purchase order contained a series of line-item releases for a single product category. Vendors were responsible for shipping the specified line items according to the specified sequence of delivery dates. When vendors shipped the goods, they sent along the general PO document as a bill of lading. But because the document contained all the release dates and quantities, Intel receiving clerks could not always tell which line item was being received.

Converting this purchasing pattern from paper to electronic required Intel to break up purchase orders and create a separate purchase order for each line-item release.

Now when vendors deliver their products, the shipping documents exactly match the items shipped.

The break-up of the purchase order is done after the Intel buyer has specified the order. The AMAPS system does it automatically. Internally, Intel references a single large PO. Externally, vendors receive many smaller POs.

Buyers still order in the same fashion as before. A single PO number is attached to a series of line-item releases. Intel's AMAPS system attaches a line-item number along with the purchase order and assigns this to the outgoing 850 as the PO number that the vendor will see.

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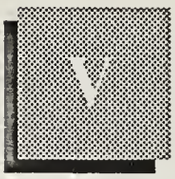
Digital Equipment Corporation



Digital Equipment Corporation

A

Corporate Overview

Digital Equipment Corporation (Maynard, MA) is the world's second-largest computer manufacturer. In 1989, with 124,000 employees and 33 manufacturing facilities, it purchased $4 billion in raw materials, supplies and services, added value to them and sold the result for a total of $12 billion.

Digital is in the unique position of being a vendor, as well as a user, of EDI systems. Today, Digital's EDI products—like many of its other products—originated within Digital to solve the internal business and system needs of the corporation. The EDI products, therefore, dovetail superbly with Digital's product philosophy of "Use what we sell, sell what we use."

B

Corporate Organization and the Role of EDI

Historically, Digital has differentiated its computer systems products from those of its competitors by stressing networked and distributed applications. Distributed computing and networking is a central design tenet among Digital engineers. This philosophy impacts the company's approach to EDI.

Digital practices what it preaches and is itself a highly networked company. Through a combination of leased telecommunication lines and Digital-owned fiber-optic lines, satellite links and transoceanic cables, Digital's corporate network ties together 41,000 computers, 124,000 users, and 132,000 phone sets across 33 countries. It is the world's largest private network—phone users can dial seven digits and get someone on another continent.

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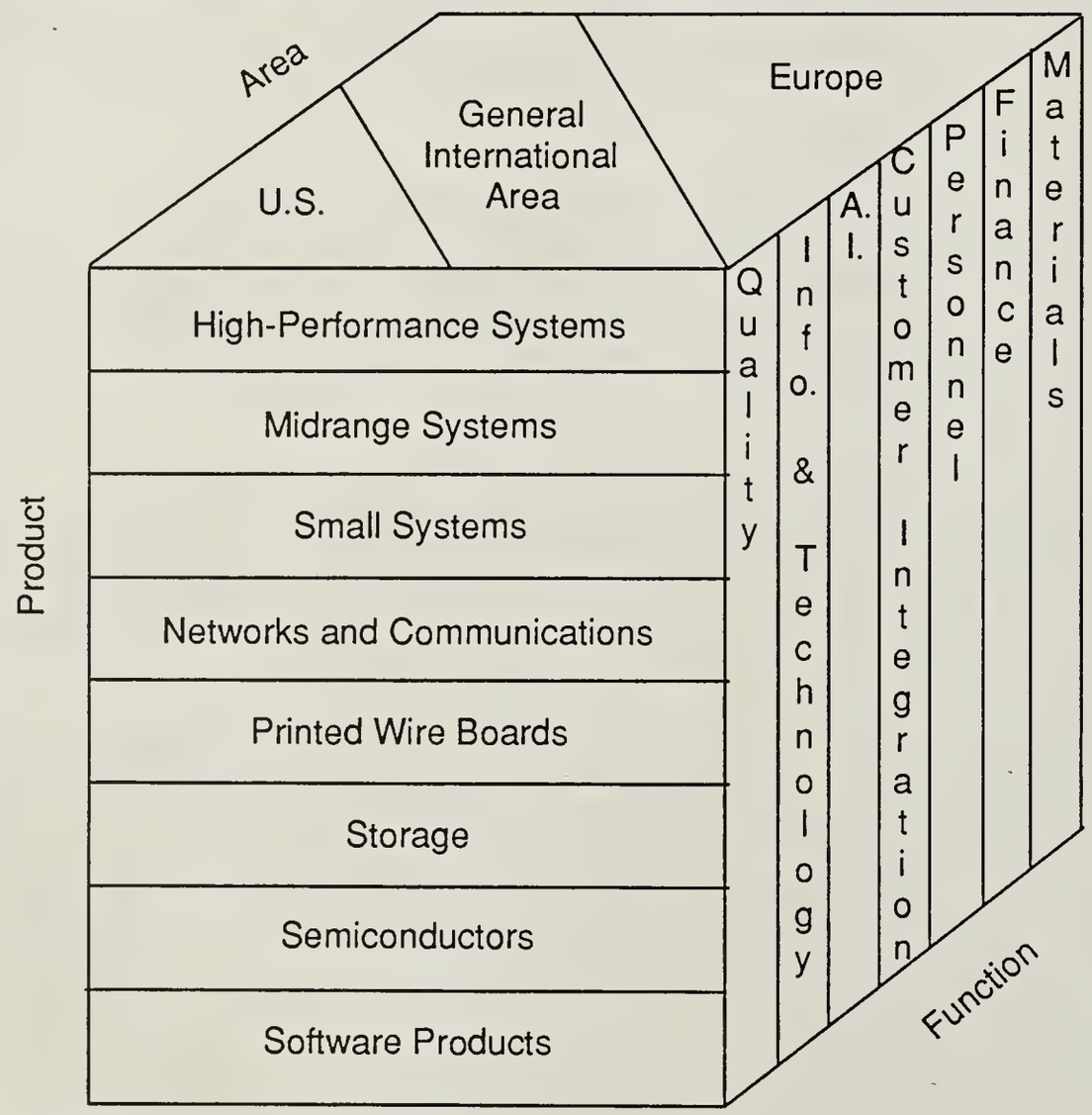
Digital classifies its product line along the following categories:

- High-performance systems
- Midrange systems
- Small systems
- Networks and communication products
- Printed wire boards
- Storage devices
- Semiconductors
- Software products

Exhibit V-1 shows organizational functions that support the manufacture of these products.

EXHIBIT V-1

Digital Equipment Corporation's Manufacturing Organization



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Although Digital's first EDI implementation began with transportation carriers in the early 1980s, its strategic roll out of EDI began in the manufacturing division that produces network and communication products.

Digital's Augusta, ME, plant was the target site for its corporate-wide EDI program. It was also the testbed for the development of its commercial EDI product. Digital's internal corporate-wide EDI program office is located in Maynard, MA, while its EDI product market organization is located in Nashua, NH, just an hour away.

C

Trading Partners and Interorganizational Systems

Seventy-five of Digital's top 100 suppliers are the same companies as 75 of Digital's top 100 customers. Motorola, for example, is both a supplier to Digital (semiconductors) and a customer (finished computer products). In a sense, Digital is merely a subloop of production processing for these companies. Or, conversely, these companies are processing subloops for Digital.

Digital managers have been quick to recognize the significance of this value-chain phenomenon. They openly acknowledge and apply the theoretical work of value chain analysis and productive confederations—models advanced by Harvard Business School academics, located only miles from Digital's corporate headquarters in Maynard, MA.

For example, Digital literature proclaims: "The enterprise encompasses more than just the corporation. Without customers and suppliers there would be no enterprise. Links in the supply chain are no longer company-dependent but product-dependent. From a process point of view, the obstacles that separate a company from its own suppliers and customers will disappear. More and more, an enterprise will do business electronically. EDI is a critical first step."

Value-chain analysis fits well with Digital's competitive advantage as a user and provider of network systems. Digital already is open to interconnecting with trading partners.

Digital's mode of operation—all internal business conducted on workstations, a wide range of VAX computer systems and interconnected networks—makes it amenable to operate in an electronically connected value chain of multiple organizations.

Thus, bolstered by theory and armed with practical equipment, Digital is actively developing electronic ties with trading partners. By 1993 it plans to conduct 80% of all external business transactions electronically.

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1. Customers

Digital has four channels for customers to place orders for products.

a. The Electronic Store

This channel is an on-line product information, quoting, and ordering service that is offered free to customers. It includes the biweekly *Digital Customer Update*, which provides information on Digital's latest products and services. Additionally, customers can query the Store for status updates on orders placed.

Although a viable sales channel, Digital wants to replace many Store orders with EDI systems. EDI orders from customers would resolve many of the Store's inherent drawbacks, which include the following:

- Not all Digital products are available for purchase through the Store. Large, complicated systems and configurations are not available. The Store is largely used for spares, supplies, and quick replenishment.
- The Store is used for low-volume purchases and information. The Store requires individual purchase orders for each item.
- The Store cannot be integrated with MRPII systems and other systems.

By 1993, Digital expects to have only 5% of all POs come in via the Store.

b. DEC Direct

Telemarketing reps field calls from customers through DEC Direct. The reps key in orders directly to Digital's order processing system. DEC Direct provides a human interface for customers who don't want to or cannot order through a terminal. Today, 60% of Digital's purchase-order transactions are conducted via DEC Direct.

c. DEC Field Offices

Located throughout the world, these offices allow customers to come in and talk face-to-face with reps about Digital products.

d. EDI

By January 1990, Digital expects to have 10 customers (for a total of 20 ordering locations) sending it EDI purchase orders. This number accounts for 2% of DEC's total purchase-order transaction volume. By the end of 1990, by adding new customers on EDI (95 of Digital's top 200

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customers are on the GEIS VAN), Digital expects to capture 10% of its order transactions via EDI. In the future, it would like to be capable of processing 80% of its order volume via EDI.

2. Suppliers

Digital is examining electronic communications with all types of suppliers.

a. Procurement

Material suppliers are of two types: inventory types provide those supplies that feed directly into production; non-inventory types provide administrative supplies such as forms, paper, office furniture, fleet cars, etc. Inventory procurement is decentralized, with each of Digital's 33 manufacturing facilities responsible for its own provisioning. Non-inventory procurement is conducted in both centralized and decentralized modes.

Although Digital's first EDI priority is to concentrate on inventory suppliers, non-inventory suppliers are potentially more important. In 1988, Digital purchased $1.7 billion in inventory supplies and $2.1 billion in non-inventory supplies.

Consequently, Digital is looking at developing a material requisition ordering (MRO) system for non-inventory purchases. Using a forms processing system starting with a requisition form from an employee passing through an approval cycle, the MRO would drive non-inventory purchasing in the same manner that MRPII drives inventory purchasing.

Already, many of Digital's largest non-inventory suppliers conduct EDI with their customers: Xerox, Kodak, GE Leasing, Boise-Cascade, Moore Business Forms, Tektronix, American Express, Chase Manhattan.

b. Transport

Digital's first experience with standard EDI began in the early 1980s with transport carriers. Today Digital does EDI with 40 carriers using TDCC standards. Digital retrieves shipment status reports using the TDCC 214 standard.

DEC's transport EDI program is presently separate from the more recently implemented ANSI X12 system. It uses neither the same translator nor the same processing architecture. Messages are sent directly to carriers, not through a VAN. All transport EDI is conducted out of Digital's Northborough, MA, distribution center. Digital intends to consolidate its transport EDI function in its corporate EDI systems architecture.

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c. Finance

Digital's domestic individual operating units (such as plants or product sales groups) receive financial processing support from financial management centers (FMCs). There are five FMCs in the U.S. that serve prescribed geographic regions. All financial and accounting transaction processing for Digital will be handled by these centers. When Digital begins financial EDI (invoicing and payments), these centers will act as the interface between Digital operating units and trading partners.

Digital's international subsidiaries have their own accounting and financial processing groups to support operating units, and use either of two international financial Consolidation Centers to interface with Corporate.

The FMCs are networked with operating groups through Digital's corporate-wide network, EasyNet. A factory will send its FMC an instruction to pay a supplier, and the FMC will prepare a payment instruction/ remittance advice (ANSI 820) which will be sent to Digital's bank.

On the customer side, the sales administration systems will prepare and send an invoice (ANSI 810) to the customer. Accounts receivable will receive electronic remittance advices from Digital's lockbox banks.

Digital's financial processing operations will, therefore, be the result of two intersecting programs: the EDI program and an ongoing corporate-wide financial architecture initiated in 1985. Patricia Flanagan is managing Digital's financial EDI program.

d. Production Partners

Digital also is looking at sharing CAD/CAM data electronically with subcontractors.

Exhibit V-2 depicts the network architecture that connects Digital's applications, EDI processing components, and trading partners.

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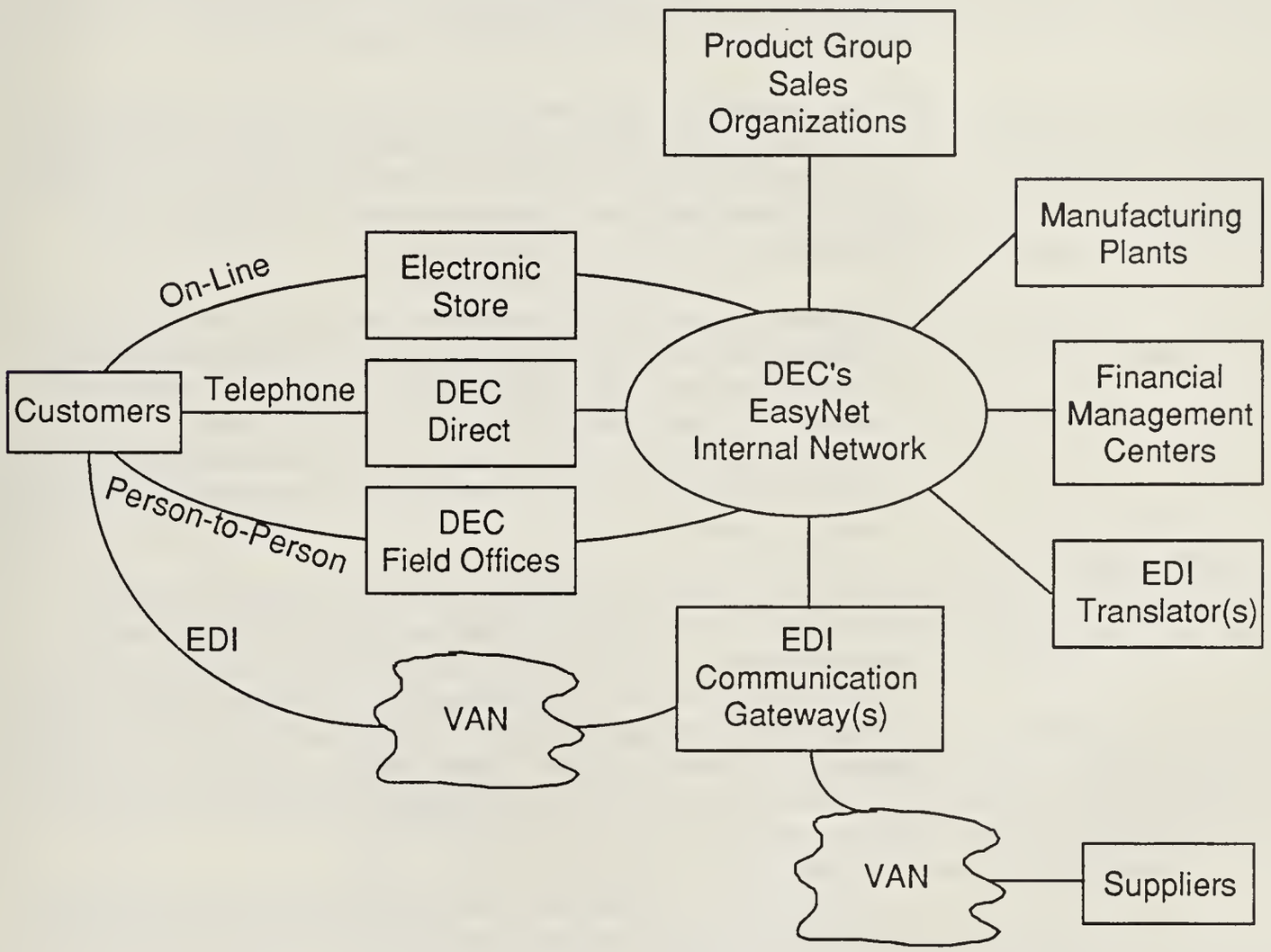
EXHIBIT V-2

Digital Equipment Corporation's EDI Applications and Support Services Are Distributed to Match Its Corporate Organization



D

History of EDI at Digital

- 1984: Digital becomes active in the American National Standards Institute (ANSI X12) Accredited Subcommittee for Electronic Data Interchange.

  - Digital begins EDI transactions, in Transportation Data Coordinating Committee (TDCC) format, with motor freight companies servicing Digital's U.S. facilities.

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- 1985: Digital acknowledges the International Standards Organization's Open Systems Interconnect standards/model as the best way to ensure interoperability of multivendor systems.

- Summer 1986: Digital holds a corporate-wide internal EDI conference and discovers that 24 groups spread throughout the world already are working on some form of EDI. Digital established an EDI Board of Directors to focus these efforts. The board is comprised of vice presidents and senior managers from across Digital functions.

  - In addition, an implementation committee is formed that does the actual work of guiding the business and technical solutions for each organizational unit. The committee reports to the board. The board gives the committee the authority to work across organization boundaries.

  - Simultaneous to initiating an EDI program, an ad hoc Digital manufacturing task force sets a strategic goal to cut the manufacturing cycle in half—from six months to three months. An internal study showed that a large portion of cycle time was devoted to materials acquisition. Digital targets its Augusta, ME, manufacturing facility as the pilot site for EDI. Augusta manufactures network and communications products.

- 1987: Digital's Augusta manufacturing plant begins exchanging electronic purchase orders and acknowledgments with Motorola, Digital's major supplier of semiconductors. This program was Digital's first EDI experience with a nontransportation vendor. The EDI project at Augusta is headed by Nancy Fitzgerald. The Augusta plant, Digital's primary American factory for network and communications equipment, will become a showcase to other Digital EDI implementations and trading partners.

  - Digital begins participation in the European Electronic Data Interchange Forum for Companies with Interest in Computing and Electronics (EDIFICE).

  - Digital becomes active in the Electronics Industry Data Exchange Association (EIDX), which is defining EDI usage for U.S. electronics companies.

  - At the TDCC show in December, Digital displays Digital Direct and third-party VAX-based EDI translation and communications software.

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- 1988: Digital releases its first EDI software product in the United Kingdom—VAX/EDI.
  - Four Digital customers (Kodak, Corning, RJR Reynolds, Dow Chemical) begin sending purchase orders to Digital in a pilot.
- 1989: The last phase of the Augusta EDI pilot has Digital's MRPII system feeding materials forecasts directly into Motorola's production scheduling system.
- In 1990, Digital anticipates bringing up more customers and suppliers. Invoices and order acknowledgements will be implemented on the customer side and EFT will begin. In 1991 it is anticipated that 80% of Digital's non-financial, external business transactions will be conducted electronically. Digital plans to deliver EDI products and services to market on a worldwide basis.
- By 1993, Digital plans to execute 80% of all its business transactions electronically.

E

How Digital Implemented EDI at Augusta

1. People

Digital manages in a matrix style. People are assigned a primary functional area (finance, information systems, marketing, etc.) but may also work in ad hoc groups that are implementing new programs. This is how Digital's corporate EDI program is being implemented.

Digital is implementing EDI through the coordinated efforts of a number of cross-functional groups. An EDI board of directors provides strategic guidance. This group is composed of vice presidents and directors from manufacturing, purchasing, MIS, engineering, finance, marketing, distribution, order processing, and materials. It meets once per quarter.

An EDI implementation committee oversees the actual divisional level implementation of EDI systems. It is composed of senior-level managers representing each board of director function plus two additional managers from Digital's legal and customs areas. It meets once every two weeks. Subordinate to the implementation committee are functional and cross-functional program teams in charge of specific implementation sites.

Digital has instituted a formal administrative procedure for its manufacturing plants to convert to EDI purchasing. In order to adopt EDI, a Digital manufacturing plant must first achieve a MRPII Class A certification. This is a rating by the American Production and Inventory Control Society that evaluates factories according to world-class manufacturing points such as inventory on hand, delivery, quality, etc. With this rating, a Digital plant is eligible to ask corporate purchasing for the necessary

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bridge software. The software links the plant's MRPII system to a DEC/EDI program interface. All Digital plants run the same MRPII software, so the bridge software has plug and play capability. The plant must also have signed a basic order agreement (BOA) between its targeted EDI trading partner(s). The BOA specifies the terms and conditions of how business will be done electronically. Also, the supplier must be a Digital-certified quality supplier (good delivery ratings, quality ratings, etc).

2. Systems

Digital operates on a network. Consequently, its approach to EDI is built around a networked and distributed architecture. The EDI software that Digital has built for its internal use follows the same architecture as its commercial product.

This EDI software consists of three independent software modules: communications, translation, and applications interface modules.

Exhibit V-3 depicts Digital's translation software design and its network connection to internal applications and external trading partners.

- The communications module acts as the interface to the external communications environment, either a third-party, value-added network or a direct connect with a trading partner's computer.

- The translation module provides the translation and management functions for the conversion of data from an organization's internal data format standard to an external EDI standard.

- The application-interface module provides the interface between the EDI-targeted application (e.g., purchasing, finance, distribution, etc.) and the translator.

Each module may reside on a single VAX computer or be distributed across multiple computers.

Modular software allows Digital to more closely fit EDI processing to the structure of its corporate organization. It allows EDI processing to be distributed by processing stage and organizational function. The goal is to optimize computing resources and information flows within the organization.

- Allocation is optimized across processing stages of an EDI transmission. A single translator and communications module can service multiple application sites. Each site (and its interface) conveys data to the central (or regional) translator. The translator interfaces with the communications module which, in turn, interfaces with the outside. The advantages of distributed processing are as follows:

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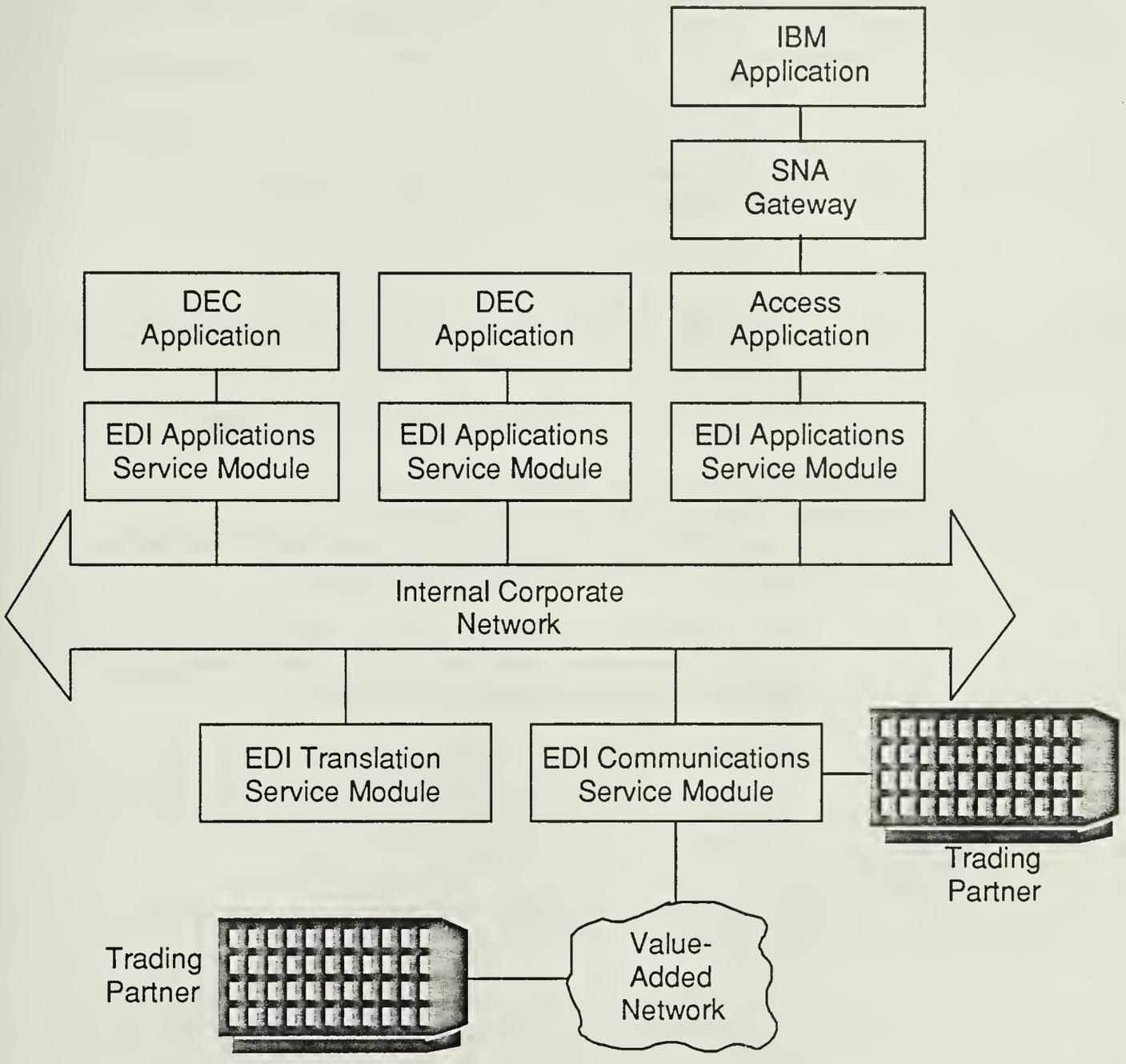
EXHIBIT V-3

Digital Equipment Corporation's EDI Architecture



Source: Digital Equipment Corporation

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- Updates of EDI standards are done centrally by single IS group.

- Modifications to application interfaces are done at the specific application site.

- Redundant equipment and software purchases are eliminated.

- Allocation is optimized across functional areas of the corporation. For example, the processing of EDI invoices (whether originated by a Digital sales group intended for a customer or received by a Digital manufacturing plant from a vendor) are handled centrally by a financial management center. The advantages are as follows:

  - Functional/labor specialization is maintained.

  - Management information is consolidated at functionally appropriate locations.

  - Redundant data and data processing is eliminated.

Processing flow may take this route:

- An EDI from a Digital customer is translated and sent via EasyNet, Digital's internal network, to the order system.

- The responsible product sales group consolidates the order with others for like products and passes on an internal build instruction to the appropriate manufacturing plant via EasyNet.

- The plant's MRPII system automatically generates a bill of materials to be ordered from suppliers. A buyer at the plant converts BOLs into purchase orders (in some cases, purchase orders are automatically generated).

- The interface in the plant's purchasing system prepares and sends the PO data to a central EDI translator on EasyNet.

- The purchase order data for the supplies is translated and sent to the communications gateway for transmission to suppliers.

- Upon receiving the purchase order, the supplier's system sends a receipt acknowledgement back to the plant, as well as a business acknowledgement confirming the purchase order.

- When the shipment is received, warehouse clerks notify both the plant's inventory system and the financial management center.

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- The invoice (electronic or paper) is routed to the financial management center. Payment is made out of the center.

F

The Impact of EDI at Digital—The Augusta Experience

Besides the TDCC-based EDI systems with 15 transportation carriers earlier in the 1980s, Digital first began EDI with nontransport trading partners with raw material suppliers to its Augusta, ME manufacturing facility.

EDI at Augusta is one component of an all-encompassing revamp of the facility to incorporate world-class manufacturing techniques, including the following:

- Just-in-time inventory control
- Total quality commitment
- Computer-integrated manufacturing
- Advanced manufacturing technologies (e.g., surface-mount technology)
- Work force planning (team approach to production-line problem solving)
- EDI

It is sometimes difficult to completely separate direct EDI benefits from the larger benefits of the Augusta plant's adoption of world-class manufacturing techniques. Some benefits, however, are attributable to business improvement opportunities made available by EDI.

At Augusta:

- Supplier lead times have been reduced by 25% to 50%
- Digital's administrative cycle time has been reduced from three to five weeks to three days.
- The placement of purchase orders has been reduced by a factor of 13. Fifty purchase orders formerly took 25 hours per week for buyers to process. Now 50 purchase orders take two hours to process. A purchase order took 30 minutes to place before; with EDI, a PO takes two minutes.
- In the case of one supplier (Motorola), purchase orders are automatically generated by Digital's MRPII system.
- Supply-inventory turns have increased by a factor of 11.
- Supply inventory has been reduced by 90% for some items.
- The time necessary to identify material requirements was reduced from an average of 5 to 10 hours to 10 minutes per week.

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- The overall dollar value of raw material inventory has been reduced by more than 50%.
- Twenty-thousand square feet (6% of the plant's total square footage) has been freed up due to less on-hand inventory.

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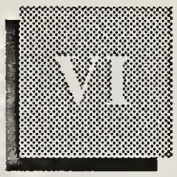
The Bekins Company



The Bekins Company

A
Corporate Overview

Los Angeles-based Bekins is a van and storage trucking company serving the continental United States and foreign countries.

Van lines are distinguished from common (truck) carriers in that van lines typically move household and higher-value fragile goods, have personnel that are trained for careful transport, and charge a premium for their services. Common carriers carry any type of good and generally do not have sophisticated care capabilities (such as trucks with good suspension, careful moving techniques, and packing personnel).

B
Trading Partners

1. Customers

Manufacturers of precision equipment use van and storage movers because of their care and quality of hauling. Bekins' top five customers in terms of dollar volume are makers of computers, photocopiers, and medical equipment. One-third of Bekins' business comes from commercial hauling of these quality manufacturers. Bekins maintains a separate division to service these customers called Specialty Distribution Services (SDS).

Two-thirds of Bekins' business comes from traditional household goods (HHG) moving.

2. Agents

Independent agents sell Bekins' hauling services for a commission. Bekins works with about 500 agents.

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Agents often perform their own local moving and storage services for the customer and use Bekins for interstate moves. For large corporate accounts, agents will "sweep" the customer's facilities daily, similar to a Federal Express pick-up service. Then they deliver the shipment to a Bekins terminal for the cross-country haul. Agents also are an important marketing arm of Bekins.

Payment of the commissions (offsets) is handled, in part, electronically through direct deposit payments via the Automated Clearing House.

C

EDI at Bekins

Prior to looking at standard EDI, Bekins had developed proprietary communication and payment systems with agents and commercial (SDS) customers.

BECOM is a PC-based software package distributed by Bekins and used by its agents. Its primary functions are to allow agents to register shipments (place an order for shipping services), query for shipment status, query for tariff schedules, and query for billing status.

The Shipper System is essentially the same software package but designed for large corporate customers.

Bekins' motivation to implement an EDI capability arose out of a contract proposal from a large customer, Digital Equipment. Digital's business was contingent on Bekins' ability to trade electronically. Bekins' management commissioned Touche Ross to conduct a feasibility study. The purpose of the study was to "evaluate and identify an implementation strategy for using EDI as a means of attracting and retaining corporate shippers."

Bekins' EDI program, although initiated before Digital's contract, was given high priority out of the desire to satisfy a customer requirement. Furthermore, the program was aimed at its commercial customers, which represent only one-third of its revenues. It is interesting to note that Bekins had been approached previously by another commercial customer, Data General, to provide EDI billing for HHG moving services. The customer maintained an employee relocation service and wanted an EDI interface with the van lines that participated in the service. However, the contract never materialized.

The Touche Ross study, delivered in December 1988, recommended a phased implementation of EDI transaction sets. The shipment status report and the electronic invoice were the first two message sets recommended.

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- In early 1989, Bekins implemented the shipment status message (TDCC 214) with Digital Equipment Corp.

- In March 1990, Bekins will begin invoicing another large corporate account (Kodak) with a shipment billing (TDCC 210) transaction set.

The second phase of the implementation schedule included a number of other transaction sets. These have not been implemented but are under consideration. In general, customer response to Bekins' EDI systems has been mild, according to Bekin's IS director. Bekins' management is positioned to implement more EDI as trading partners are established.

Among the next round of transactions to be brought up are the following:

- Shipment tendering (TDCC 214): Essentially, this transaction is a purchase order by a shipper where the rates have been pre-established by contract.

- Remittance processing/electronic payment (ANSI X12 820): Two customers (Kodak and Wang) have expressed interest in paying Bekins electronically.

- Asset management: Here, Bekins coordinates and manages shipper goods that are stored in its warehouses. Bekins is considering WINS and UCS transaction sets.

D

EDI Hardware and Software

Bekins On-Line Dispatch System (BOLDS) is an integrated internal system that facilitates order-entry, shipment tracking, and consolidation and billing. BOLDS existed prior to Bekins' foray into EDI. BOLDS runs on IBM mainframes and connects with Bekins' field offices and warehouses via an SNA network and the BT/TYMNET VAN. BOLDS is the system that produces and receives EDI data.

Until its EDI transmissions increase in volume, Bekins is having its data translation performed by its third-party value-added network, Kleinschmidt, which polls Bekins' system every evening.

E

Current and Expected Impact of EDI at Bekins

Implementing the status shipment and shipment billing transaction sets required two to three months of programming and testing. Total programmer costs were approximately $30,000 for each transaction set (using an in-house programmer's rate of $40/hour).

Bekins did not purchase a translator. The largest benefit of the program was the attraction and retention of two large corporate accounts, Digital Equipment Corporation and Kodak. The Digital contract alone was worth $600,000 to $700,000.

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Touche Ross estimated increased benefits if Bekins were to implement more transaction sets and with a greater number of top customers.

These benefits fall into three categories:

- Revenue Enhancement
  - The further attraction and/or retention of large accounts that require EDI
  - Attraction of corporate customers that want to conduct EDI for HHG moving services (usually for employee relocation programs)
  - The speeding up of bill collections due to electronic invoicing. Touche Ross estimates Bekins could realize $41,000 in additional interest income per year if the top five commercial shippers were billed with an EDI invoice (assuming 7% interest and three days reduction in mailing time).
- Cost Savings
  - One out of the 20 customer service personnel (at a loaded salary of $16,000 per year) could be eliminated if the top five shippers (10% of shipment volume) can be switched to EDI shipment status communication.
  - An additional accounts receivable employee ($16,000 per year salary) could be eliminated.
  - And, $3,000 to $7,000 could be saved in reduced postage for invoicing.
- Nonfinancial
  - Increased accuracy in shipment status and invoicing due to the reduction in manual effort in providing interfaces between Bekins, agents, and shippers
  - Increased service levels and credibility with both agents and shippers, because status, invoice, and remittance information will increase in timeliness and quality
  - Increased service to the shipper that can access information in its mailbox on a 24-hour-a-day basis, receive a common format of invoices and status messages from all its carriers, and create a data base of shipment performance for carrier management

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- Increased productivity and morale on the part of administrative and customer service personnel who can concentrate on more proactive forms of customer service in lieu of servicing routine freight status inquiries, reduce their manual effort in rekeying data from paper, and focus on exception situations rather than clerical and filing tasks

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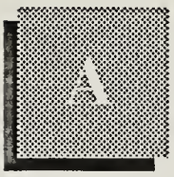
Appendix: INPUT EDI Case Study Outline and Questions



Appendix: INPUT EDI Case Study Outline and Questions

A

Application Description

A-1. Functional Business Description

A-2. Company Business Parameters (sales, employees, locations, etc.)

A-3. IS Applications
- Internal
- External/Interface
  - peer
  - self-supplied (generally downstream)

A-4. EDI Description/Overview (who with, what types of data)

→ Do you have any schematics, diagrams, or charts that would help understand the approach you've taken to EDI?

→ What types of trading partners are involved?
. Suppliers
. Customers
. Transportation carriers
. Banks
. Others

B

History/Justification of EDI

B-1. Why—what was the impetus to look into EDI?

→ How did it first come up?

→ What were the key/primary motivators?
. Trading partner pressure
. Cost savings
. Inventory control
. Customer service

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B-2. How was it justified?

→ What were the "hard" (tangible/quantifiable) benefits?

→ What were the "soft" (intangible/quality) benefits?

→ Who received these benefits?

→ How were the time and expense of development traded off against the benefits?

B-3. Describe the analysis/decision/steering process.

→ Was there a task force or study group formed? If so, who was represented on the group?

→ What was the process used to analyze costs and benefits?

→ What was the process used to arrive at decisions regarding implementation/priorities/etc.?
. Who participated?
. How was the process steered/managed?
. What levels of review/approval were required?
. How were decisions communicated/sold to participants?

B-4. Describe your participation in industry standards setting, steering committees, user groups, etc.

→ What groups were involved?
. Who from your company participated?
. What groups did you participate in?
. How were these choices made?

→ Was your participation active or passive?

→ Did your firm take public positions on issues, or was your role and activity not publicly discussed?

→ How did your participation influence decisions regarding your own EDI program?

C

Implementation—Technology Choices

C-1. What kind of hardware are you using, and why?

→ How did you choose between micro/mini/mainframe?

→ How did you choose vendor?

C-2. What kind of software are you using, and why?

→ How did your hardware/software choices relate—which was the driving force: hardware or software?

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→ How did you choose vendor, or make decision to develop in-house?

C-3. What network(s) are you using, and why?

→ How did hardware/software relate to your network choice?

→ Were/are there specialized/standard vendors for your industry?

→ How did you choose vendor(s)—what were the key issues?
. Security
. Connectivity to customers/suppliers
. Translation capabilities
. Cost
. Service quality/level

D

Implementation—Management Process

D-1. What was the role taken by various groups in developing and implementing EDI?
- Top (corporate) management
- Corporate staff groups
- Divisional/functional area management
- IS management

D-2. What kind of internal resistance was encountered, and how was it handled?

D-3. How did you get your trading partners involved?

→ Did they come to you, or did you go out and promote EDI?

→ What external forces influenced your trading partners (e.g., industry standards/planning groups)?

→ What (if anything) did you do to motivate your trading partners to shift to EDI? What did your trading partners do to influence you to adopt EDI? What incentives were provided by/to whom?
. Cost savings
. Improvement in service levels

D-4. What kind of support (if any) did you give your trading partners to help them implement their part of the EDI process?
- Technical/planning assistance
- Providing software and/or hardware
- Training/documentation
- "Help desk" functions

D-5. What kind of external resistance was encountered, and how was it handled?

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E

Implementation—Review

E-1. What is your overall evaluation of the results you have achieved so far in implementing EDI vs. your original expectations?
- Cost/time/difficulty of implementation
- Volume/extent of usage
- Benefits realized
- Participation by trading partners

E-2. Have you undertaken any formal reviews of your original plans and forecasts vs. actual results?
- Development/implementation cost/schedule
- Hard benefits ($ savings, ROI, etc.)
- Soft benefits (market share, service/quality levels, etc.)
- Who realized the benefits (internal, external)

E-3. If so, who conducted these reviews, and how were the results utilized?

E-4. What problems did you encounter, and what mistakes did you make? If you were starting over, what would you do differently?

E-5. What advice would you have for others who are just starting out with EDI?

ıre of EDI

F-1. Please describe where you see EDI headed in the future:
- within your firm
- within your industry
- overall (including network and service providers, hardware and software providers, etc.)

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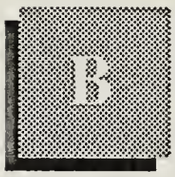
Appendix: Glossary of EDI Terms



Appendix: Glossary of EDI Terms

ACCS - "Access." *Also*, the Aluminum Customer Communication System.

ACH - Automated Clearing House, a banking industry mechanism for electronic funds transfer. *Also see* NACHA.

AIAG - The Automotive Industry Action Group, a trade association. *Also* refers to EDI formats developed by the association.

ANA - Article Numbering Association, the U.K. industry group that introduced bar coding to that country and developed the Tradcoms EDI standard.

ANSI - American National Standards Institute.

ASC - Accredited Standards Committee.

Bar Coding - A standardized method of identifying products that facilitates data entry through scanning of coded printed labels.

Batch Processing - A data processing/data communications method that groups transactions. Compare to real-time processing.

CAD/CAM - Computer Assisted Design and Computer Assisted Manufacturing, a set of applications that use graphics to manage these functions.

CARDIS - Cargo Data Information System, a concept for trade documentation automation promoted by the National Council on International Trade Documentation. It has never been implemented in its proposed form. "CARDIS Element Systems" have been developed by several vendors serving the international trade community.

CCD - Cash Concentration and Dispursement, an electronic funds transfer format.

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CEFIC - The Brussels-based Council of European Chemical Manufacturers, which sponsors an EDI project.

CIDX - Chemical Industry Data Exchange, a standard based on X12.

CLM - Car Location Messages, applied to rail car logistics.

Compliance Checking - A function which verifies that document information is received in the right order and in the proper format.

COMPORD - Computerized Ordering, an EDI system developed by the American Iron and Steel Institute.

COPAS - Council of Petroleum Accounting Standards, an industry association developing EDI standards.

CSI - Commercial Systems Integration, a professional service whereby vendors take complete responsibility for designing, planning, implementing, and sometimes managing a complex information system.

CTP - Corporate Trade Payments, an electronic funds transfer application.

CTX - An electronic funds transfer mechanism that is compatible with the EDI X12 standard and that carries information about a payment as well as transferring value.

DISH - Data Interchange for Shipping, a project sponsored by a European group of shippers, carriers, and agents.

EDI - Electronic Data Interchange. The computer-to-computer communications based on established business document standards, or using translations by EDI software housed on users' computers, located at remote computer service bureaus or on value-added network processors.

EDICT - Istel's U.K. EDI service.

EDIFACT - EDI for Administration, Commerce, and Transportation, the evolving international EDI standard.

EDX - Electronics Industry Data Exchange, based on the X12 standard.

EFT - Electronic Funds Transfer, the transfer of value.

Electronic Mail - The transmission of text, data, audio, or image messages between terminals using electronic communications channels.

Electronic Mailbox - A store and forward facility for messages maintained by a transmission or processing facility.

EMBARC - An EDI standard being promoted for use in the paper, printing, and publishing industries.

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EMEA - Council for Mutual Economic Assistance, an Eastern Europe-bloc EDI association.

FASLINC - The Fabric and Supplier Linkage Council, a textile industry association dedicated to EDI development and other industry needs.

GTDI - General Trade Data Interchange, an international standard developed from TDI accommodating compromises between French participants in SITPRO, the agency behind U.N. certification of the standard. It is evolving into EDIFACT.

HCFA - Health Care Financing Administration, a U.S. government agency responsible for Medicare administration. *Also* describes a format (HCFA 1500) for health care insurance claims.

ICOPS - The Industry Committee on Office Products Standards, sponsored by two office products trade associations for EDI applications.

IGES - International Graphics Exchange Standard, by which CAD/CAM graphics can be transferred electronically.

IIR/ACORD - Standards for paper and electronic insurance documents, developed by the Insurance Institute for Research and the Agent Company for Research and Development, which have merged.

Interface - The insurance industry term for EDI, using IIR/ACORD formats.

IRC - International Record Carrier, a common carrier providing messaging and network services. It is no longer limited to international communications.

IVANS - Insurance Value-Added Service, provided on IBM's Information Network by an insurance industry association.

JEDI - The Joint Electronic Data Interchange Committee, which consisted of representatives of industry trade associations coordinating development of a reference EDI dictionary for the creation of new EDI transactions, segments, or data elements for international use. Its work has largely been supplanted by UNECE Working Party 4.

JIT - Just-in-time, an inventory management philosophy that plans delivery of needed materials and components immediately prior to final manufacture or assembly.

LDI - Logistics Data Interchange, information about the location of materials in transit through the manufacturing/distribution cycle.

NACHA - National Automated Clearing House Association, a banking services industry group.

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ODETTE - Organization for Data Exchange through Teletransmission in Europe, an automaker's association EDI standard.

Ordernet - Sterling Software's EDI service. *Also* refers to EDI standards developed by the National Wholesale Druggist's Association for use in pharmaceuticals.

RCS - A Remote Computing Service facility which arranges to process some or all of a user's workload. Similar to a VAN (below) but without network services.

Real-time - A data processing or transmission method with data entered interactively. Response to input is fast enough to affect subsequent input. The results are used to influence a currently occurring process.

SAFLINC - The Sundries and Apparel Findings Linkage Council, an association in the apparel and related industries promoting EDI and other industry needs.

SAM - Shippers Administrative Messages, a logistics service/application.

SITPRO - Simplification of Information Trade Procedures, a European EDI standards and trade facilitation agency that reports to the Department of Trade and Industry.

SMMT - Society of Motor Manufacturers and Traders, an automotive industry association responsible for the ODETTE project.

Store and Forward - The capability of a transmission or processing facility to hold messages or data until requested or until a prescheduled time.

SUPER - Study for the Utility of Processing Electronic Returns, an Internal Revenue Service test for electronic filing.

SUPERB - The IRS' electronic filing test program for business returns.

TALC - Textile/Apparel Linkage Council, a subcommittee addressing EDI standards.

TAMCS - Textile/Apparel Manufactuer's Communications Standards.

TCIF - Telecommunications Industry Forum, an industry group involved in EDI, bar coding, and similar technologies.

TDCC - The Transportation Data Coordinating Committee, an early advocate of EDI, now in the process of changing its name to the Electronic Data Interchange Association. *Also* refers to U.S. EDI standards.

TDI - Trade Data Interchange, an international shipping standard. *Also see* GTDI.

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TEDIS - An EEC program to promote Trade EDI throughout industry and government.

Tradanet - An ICL (U.K.) EDI service.

Translation - Transforming information sent in one format to another format.

UB82 - A format for health claims insurance submissions.

UCS - Uniform Communications Standards, the EDI standards used by the grocery industry, based on X12 and coordinated by the Uniform Product Code Council.

UNECE - United Nations Economic Commission for Europe. Despite its name, a broadly based representational body developing the international EDI standards called EDIFACT.

UNJEDI - United Nations Joint EDI committee developing technical and procedural standards on EDI.

VAN - Value-Added Network, a common carrier network transmission facility, usually augmented with computerized packetizing which may also provide store and forward switching, terminal interfacing, and error detection and correction and host computer interfaces supporting various communications speeds, protocols, and processing requirements.

VANGUARD - A U.K. Department of Trade and Industry-sponsored awareness and promotional program for VAN and EDI services.

VICS - Voluntary Inter-Industry Communications Standards, a committee developing EDI standards between retailers and manufacturers.

WINS - Warehouse Information Network Standards, promoted by two representational associations, the International Association of Refrigerated Warehouses and the American Warehousemen's Association.

WP4 - Working Party 4 of the Economic Commission for Europe, commissioned by the U.N. to develop trade facilitation procedures and international EDI standards.

X.400 - A set of international electronic messaging standards.

X12 - A set of generic EDI standards, approved by the American Standards Committee.

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Analyses	☐	☐	☐	☐	☐
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Cover new areas not covered elsewhere	☐	☐	☐	☐	☐
Confirm existing ideas	☐	☐	☐	☐	☐
Meet Expectations	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

6. Which topics in the report were the most useful? Why?_____

_____

7. In what ways could the report have been improved? _____

_____

8. Other comments or suggestions: _____

_____

_____
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_____
Department

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Company

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Thank you for your time and cooperation.

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